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**Evidence-based knowledge on the aesthetics and maintenance of  
peri-implant soft tissues: Osteology Foundation Consensus Report Part  
1-Effects of soft tissue augmentation procedures on the maintenance of  
peri-implant soft tissue health**

Giannobile, William V ; Jung, Ronald E ; Schwarz, Frank

**Abstract:** **OBJECTIVES** The goal of Working Group 1 at the 2nd Consensus Meeting of the Osteology Foundation was to comprehensively assess the effects of soft tissue augmentation procedures on peri-implant health or disease. **MATERIALS AND METHODS** A systematic review and meta-analysis on the effects of soft tissue augmentation procedures included a total of 10 studies (mucosal thickness: n = 6; keratinized tissue: n = 4). Consensus statements, clinical recommendations, and implications for future research were based on structured group discussions and a plenary session approval. **RESULTS** Soft tissue grafting to increase the width of keratinized tissue around implants was associated with greater reductions in gingival and plaque indices when compared to non-augmented sites. Statistically significant differences were noted for final marginal bone levels in favor of an apically positioned flap plus autogenous graft vs. all standard-of-care control treatments investigated. Soft tissue grafting (i.e., autogenous connective tissue) to increase the mucosal thickness around implants in the aesthetic zone was associated with significantly less marginal bone loss over time, but no significant changes in bleeding on probing, probing depths, or plaque scores when compared to sites without grafting. **CONCLUSIONS** The limited evidence available supports the use of soft tissue augmentation procedures to promote peri-implant health.

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# Evidence-based knowledge on the aesthetics and maintenance of peri-implant soft tissues: Osteology Foundation Consensus Report Part 1—Effects of soft tissue augmentation procedures on the maintenance of peri-implant soft tissue health

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## Abstract

**Objectives:** The goal of Working Group 1 at the 2nd Consensus Meeting of the Osteology Foundation was to comprehensively assess the effects of soft tissue augmentation procedures on peri-implant health or disease.

**Materials and methods:** A systematic review and meta-analysis on the effects of soft tissue augmentation procedures included a total of 10 studies (mucosal thickness:  $n = 6$ ; keratinized tissue:  $n = 4$ ). Consensus statements, clinical recommendations, and implications for future research were based on structured group discussions and a plenary session approval.

**Results:** Soft tissue grafting to increase the width of keratinized tissue around implants was associated with greater reductions in gingival and plaque indices when compared to non-augmented sites. Statistically significant differences were noted for final marginal bone levels in favor of an apically positioned flap plus autogenous graft vs. all standard-of-care control treatments investigated. Soft tissue grafting (i.e., autogenous connective tissue) to increase the mucosal thickness around implants in the aesthetic zone was associated with significantly less marginal bone loss over time, but no significant changes in bleeding on probing, probing depths, or plaque scores when compared to sites without grafting.

**Conclusions:** The limited evidence available supports the use of soft tissue augmentation procedures to promote peri-implant health.

## KEYWORDS

connective tissue grafting, dental implant, peri-implant diseases, soft tissue augmentation, soft tissue regeneration, wound healing

## 1 | INTRODUCTION

Nowadays, soft tissue grafting has become a topic of growing interest in implant dentistry. The proposed surgical procedures mainly aim at increasing either (i) the width of keratinized tissue or (ii) the soft tissue

volume at dental implant sites to improve functional, aesthetic, and biological outcomes after therapy (Thoma, Buranawat, Hammerle, Held & Jung, 2014).

Biological complications refer to inflammatory conditions occurring in tissues around dental implants and are initiated by the host

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response to a bacterial challenge (Jepsen et al., 2015; Lang et al., 2011; Sanz et al., 2012). While previous systematic reviews provide some evidence that implant sites exhibiting an inadequately dimensioned keratinized tissue (i.e., width of <2 mm) were more prone to plaque accumulation and peri-implant soft tissue inflammation than implant sites exhibiting a keratinized tissue of  $\geq 2$  mm (Gobbato, Avila-Ortiz, Sohrabi, Wang & Karimbux, 2013; Lin, Chan & Wang, 2013), the effects of soft tissue volume grafting on biological outcomes are currently unknown.

Therefore, a task of Working Group 1 of the Osteology Foundation Consensus Meeting was to comprehensively assess the effects soft tissue augmentation procedures on peri-implant health or disease.

## 2 | WORKSHOP DISCUSSION AND CONSENSUS

The present Part 1 of the Osteology Foundation Consensus Report was based on the following review:

1. Effects of soft tissue augmentation procedures on peri-implant health or disease—a systematic review and meta-analysis (Thoma et al., 2017).

At the beginning of the meeting, the authors presented the systematic review in detail (i.e., methodology, results, conclusions) to the participants. Subsequently, the participants were separated into two working groups (Group 1: maintenance of peri-implant soft tissues; Group 2: aesthetics of peri-implant soft tissues). Discussions and the formulation of consensus statements within groups were each directed by one chairperson and one secretary. The statements, elaborated by the members of the working groups, were presented and discussed in plenary sessions and revised according to the suggestions made by the audience. Finally, consensus statements, clinical recommendations, and implications for future research were approved.

### 2.1 | Effects of soft tissue augmentation procedures on peri-implant health or disease—a systematic review and meta-analysis (Thoma et al., 2017)

#### 2.1.1 | Focused question

In systemically healthy patients with dental implants, what is the effect of soft tissue grafting procedures to increase the width of keratinized tissue or the mucosal thickness at dental implant sites in comparison with implant sites without soft tissue grafting procedures or with different grafting materials/transplants on peri-implant health?

#### 2.1.2 | Major findings

Soft tissue grafting to increase the width of keratinized tissue around implants:

1. Greater reductions in gingival (GI) and plaque indices (PI) were found following mucosal augmentation procedures when compared to non-augmented sites [GI change:  $n = 2$ ; WMD = 0.863; 95% CI (0.658; 1.067);  $p < .001$ ]; [PI change:  $n = 2$ ; WMD = 0.344; 95% CI (0.179; 0.509);  $p < .001$ ], respectively. There were no differences with regard to bleeding on probing (BOP) between augmented and non-augmented sites.
2. Statistically significant differences were noted for final marginal bone levels in favor of an apically positioned flap (APF) plus autogenous grafts vs. all control treatments [ $n = 4$ ; WMD =  $-0.175$  mm; 95% CI: ( $-0.313$ ;  $-0.037$ );  $p = .013$ ].

Soft tissue grafting to increase the mucosal thickness around implants in the aesthetic zone:

1. Significantly less marginal bone loss over time was observed with the use of connective tissue graft [ $n = 2$ ; WMD = 0.110 mm; 95% CI: (0.067; 0.154);  $p < .001$ ] compared to sites without grafting.
2. Grafting using connective tissue did not result in significant changes in BOP, probing depths (PD), or plaque scores when compared to controls.

### 2.2 | Consensus statements regarding soft tissue grafting to increase the width of keratinized tissue and mucosal thickness

1. The limited evidence available supports the use of soft tissue augmentation procedures to promote peri-implant health.
2. In the studies investigated, peri-implant health/ disease was assessed by clinical parameters including GI, BOP, PD scores as well as marginal bone levels. However, the incidence/prevalence of peri-implant diseases, based on clearly defined case definitions, has not been sufficiently reported.

#### 2.2.1 | Keratinized tissue

1. The surgical procedures to increase the width of keratinized tissue included an apically positioned split-flap/vestibuloplasty (APF) with or without the application of autogenous tissue (i.e., free gingival graft) or a collagen matrix. The timing of the procedures following implant placement varied considerably among studies but was commonly accomplished after the final prosthetic restoration. The respective clinical indications included either the absence or a reduced width of keratinized tissue ( $\leq 2$  mm) at implant sites.
2. It remains unclear as to whether or not the augmentation of keratinized tissue may positively affect self-performed oral hygiene measures and subsequently the occurrence of peri-implant soft tissue inflammation when compared with non-augmented, inadequately dimensioned implant sites.
3. The presented meta-analyses have pointed to statistically significant differences in terms of PI and GI scores as well as PD values in

favor of sites with an augmented keratinized tissue. Marginal bone levels show better stability following application of autogenous grafts.

### 2.2.2 | Mucosal thickness

1. The surgical procedures to increase the mucosal thickness at implant sites commonly included the immediate or delayed placement of subepithelial connective tissue grafts. The respective clinical indications included a prevention of mucosal recessions/compensation of volume deficiencies and facilitation of tissue adaptation at implant placement for functional and/or aesthetic purposes.
2. A thickening of the mucosa by means of subepithelial connective tissue grafts was not associated with any significant differences in PI, BOP, or PD as compared to control. Statistically significant higher interproximal marginal bone levels were obtained following the application of connective tissue grafts when compared to control sites.

### 2.3 | Clinical recommendations regarding soft tissue grafting to increase the width of keratinized tissue and mucosal thickness

1. The clinician may consider the use of autogenous soft tissue grafting to promote peri-implant soft tissue health or marginal bone levels at implant sites with insufficient soft tissue dimensions.

#### 2.3.1 | Keratinized tissue

1. It is anticipated that plaque control is better facilitated in the presence of >2 mm of keratinized tissue.
2. When increasing the zone of keratinized tissue is desired around an implant, the clinician should consider performing a free gingival graft.

#### 2.3.2 | Mucosal thickness

1. When increasing soft tissue thickness around implant sites displaying volume deficiencies is desired, clinicians should consider connective tissue grafting procedures to promote greater stability of interproximal marginal bone levels.

### 2.4 | Implications for future research

Further investigations should consider:

1. to use accepted case definitions in terms of peri-implant health and disease when performing clinical studies for gain of keratinized tissue and mucosal thickness;

2. determine the role that soft tissue characteristics play in the homeostasis and stability of peri-implant bone, and vice versa;
3. to design controlled clinical studies evaluating soft tissue grafting procedures with a primary endpoint for peri-implant health (BOP, GI);
4. to evaluate different surgical techniques and materials for superiority in terms of maintaining and/or enhancing peri-implant health;
5. to assess whether or not the time-point of performing soft tissue grafting procedures influences peri-implant health;
6. to assess the relationship between soft tissue grafting procedures for gain of keratinized tissue and the ability to perform oral hygiene and brushing discomfort;
7. the use of improved diagnostic soft tissue imaging technologies to discriminate between health and disease as well as assess soft tissue volume;
8. the effects of soft tissue augmentation procedures at diseased implant sites;
9. and to evaluate surgical procedures to allow for the reduction in soft tissue augmentations.

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### CONFLICT OF INTEREST

The authors and members of the working groups declare that they have no conflict of interests related to this consensus report. WVG, REJ, and FS are members of the Osteology Foundation Board.

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